to about 60 grams of sulfuric acid per liter of solution and having manganese sulfate therein in an amount whereby manganese ion is present in the range of from about 5 to about 50 grams of manganese per liter of solution, the amount of sulfuric acid in said electrolyte solution being greater than or equal to 1.2 times the amount of manganese ion therein; and

applying electric current to said electrodes whereby said anodic electrode current density is in the range of from about 2.5 to about 4.5 amperes per square foot and said high discharge capacity EMD produced is deposited on said anodic electrode.

Please amend claim 14 as follows.

14. (Amended) EMD having a [high] discharge capacity of about 68.2 mAh/g at [high] a discharge rate of 1 Watt [rates] produced in accordance with the method of claim 1.

Please amend claim 15 as follows:

15. (Amended) EMD having a [high] discharge capacity of about 68.2 mAh/g at [high] a discharge rate of 1 Watt [rates] produced in accordance with the method of claim 7.

Please amend claim 16 as follows:

16. (Amended) EMD having a [high] discharge capacity of about 68.2 mAh/g at [high] a discharge rate of 1 Watt [rates] produced in accordance with the method of claim11.

Please cancel claims 17-20.

Remarks

The Office Action mailed March 28, 2000 has been carefully reviewed as have the references cited therein. As a result, claims 1, 7 and 14-16 have been amended and claims 17-20 have been cancelled. The reconsideration of this application in view of such amendments and these remarks is respectfully requested.

In the Office Action, the Examiner required restriction to one of the following inventions under 35 U.S.C. §121: Claims 1-16, drawn to a process for making electrolytic manganese dioxide or claims 17-20, drawn to an electrode. During a telephone conversation between the Examiner and the undersigned attorney for Applicants, a provisional election was made to prosecute the invention of claims 1-16. The provisional election is hereby affirmed by the Applicants.

As a result of the above described election, claims 17-20 have been cancelled herein. Such cancellation is without prejudice to the filing of a divisional application directed to claims 17-20.

In the Office Action, the Examiner rejected claims 1-4, 6-8 and 10 under 35 U.S.C. §103(a) as being unpatentable over Takehara (5,746,902) et al. In connection with this rejection, the Examiner stated that the ranges for anodic current density, manganese ion concentration, sulfuric acid concentration and temperature overlap those disclosed by Takehara et al. and that choices of values within the ranges of process parameters disclosed by Takehara et al. would have been obvious.

As set forth at page 8 of the present application and in the Takehara et al. patent, the process parameters taught by Takehara et al. are as follows: an electrolyte solution temperature ranging from 94°C to 103°C; an electrolyte solution sulfuric acid concentration ranging from 29.4 to 44.1 g/l; a manganese sulfate concentration ranging from 27.5 to 55 g/l; and an anodic electrode current density ranging from 3.7 to 8.4 amperes per square foot. The ratio of sulfuric acid to manganese ion in the electrolyte solution of Takehara et al. is from 1.07 at the low ends of the above ranges to 0.8 at the high ends of the ranges.

The process parameters of the present invention are an electrolyte solution having a temperature from about 95°C to about 98°C, an acid concentration ranging from about 20 to about 60 grams per liter, a manganese ion concentration ranging from about 5 to about 50 grams per liter and an anodic electrode current density from about 2.5 to about 6 amperes per square foot. In addition, at page 10, line 19 of the present application as originally filed, it is stated that the concentration of the sulfuric acid in the electrolytic solution is maintained at a level greater than or equal to 2 times the concentration of manganese therein.

The specification of the present application has been amended at page 9, line 24 to call for the concentration of sulfuric acid to be at least equal to about 1.2 times the concentration of manganese ion therein. At page 10, the sentence beginning at line 19 has been amended to read: "In addition, the concentration of the sulfuric acid in the electrolytic solution is maintained at a level greater or equal to 1.2 times the concentration of manganese ion therein, and more preferably, at a level greater than or equal to 2 times the concentration of manganese ion therein."

It is respectfully submitted by the Applicants that the amendments made to the specification do not constitute new matter. The reason for this is that while the specification as originally filed called for the sulfuric acid to be present in the electrolyte solution in a concentration in the range of from about 20 to about 60 grams per liter and for the manganese to be present therein in a concentration from about 5 to about 50 grams of manganese per liter, the specification also inconsistently stated that the concentration of the sulfuric acid in the electrolytic solution is maintained at a level greater than or equal to 2 times the concentration of the manganese ion therein. The ratio of the concentration of the sulfuric acid to the concentration of the manganese ion at the low ends of the above ranges is about 20 grams per

liter of sulfuric acid to about 5 grams per liter of manganese ion, or a ratio of about 4, and at the high end about 60 grams per liter of sulfuric acid to about 50 grams per liter of manganese ion, or a ratio of about 1.2. Thus, the specification before being amended herein clearly indicated that the concentration of sulfuric acid in the electrolyte solution should be at least equal to 1.2 times the concentration of manganese ion therein (60 grams per liter divided by 50 grams per liter). The maximum ratio of sulfuric acid to manganese ion is at the low end of the ranges, i.e., a ratio of about 4.

Thus, it is respectfully submitted by the Applicants that the amendments to the specification clarify what was already stated in the specification and do not add new matter to the application.

Based on the above described amendments to the specification, claims 1 and 7 have both been amended to call for "the amount of sulfuric acid in said electrolyte solution being greater than or equal to 1.2 times the amount of manganese ion therein." Claims 2-4 and 6 are dependent from claim 1 and claims 8 and 10 are dependent from claim 7.

It is respectfully submitted by the Applicants that claims 1-4, 6-8 and 10 as amended are patentably distinguished from Takehara et al. for the reason that Takehara et al. does not disclose or suggest that the sulfuric acid in the electrolyte solution should be greater than or equal to 1.2 times the concentration of manganese ion therein and more preferably, greater than or equal to 2 times the concentration of manganese ion therein. It is the combination of the concentration of sulfuric acid in the electrolyte solution being at least equal to about 1.2 times the concentration of manganese ion therein in combination with an anodic electrode current density in the range of from about 2.5 to about 6 amperes per square foot that produces the unexpected EMD properties

set forth in Table I at page 11. Accordingly, it is respectfully submitted that claims 1-4, 6-8 and 10 should now be allowed.

The Examiner rejected claims 5 and 9 under 35 U.S.C. §103(a) as being unpatentable over Takehara et al. as applied to claims 1-4, 6-8 and 10 and further in view of Riggs, Jr. (4,477,320).

Claims 5 and 9 are dependent from claims 1 and 7, respectively, and both call for the cathodic electrode to be comprised of copper. While the Examiner is correct that the patent to Riggs, Jr. discloses a method for producing EMD in which cathodes fabricated from copper and alloying amounts of other metals are used, it is respectfully submitted that claims 1 and 7 as amended are allowable and claims 5 and 9 which are dependent therefrom are also now allowable.

The Examiner rejected claims 14-16 under 35 U.S.C. §102(e) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Takehara et al. The Examiner also rejected claims 14-16 under 35 U.S.C. §112, second paragraph, as being indefinite.

Claims 14-16 have been amended to call for EMD having a discharge capacity of about 68.2 mAh/g at a discharge rate of 1 Watt produced in accordance with the methods of claims 1, 7 and 11, respectively. The discharge capacity of about 68.2 mAh/g at the 1 Watt discharge rate called for is set forth in Table I at page 11 of the specification. It is respectfully submitted that the amendments to claims 14-16 are no longer indefinite and are patentably distinguished from the Takehara et al. patent in that they call for the discharge capacity of the EMD of the present invention which is unexpectedly higher than the discharge capacity at 1 Watt discharge rate for the prior art including Takehara et al. Thus, it is respectfully submitted that claims 14-16 should now also be allowed.

The Examiner allowed claims 11-13 and such allowance is acknowledged and appreciated. It is respectfully submitted that amended claims 1-10 and 14-16 are also allowable for the reason that the combinations of process parameters recited are not suggested by Takehara et al. taken alone or together with the other prior art cited in this application. Further, the methods of the present invention result in the production of EMD which has unexpectedly better properties that the EMD produced by the prior art. Thus, for all of the reasons set forth herein, it is respectfully submitted by the Applicants that claims 1-10 and 14-16 should be allowed.

This is intended to be a complete response to the Office Action mailed March 28, 2000.

Respectfully submitted,

C. Clark Dougherty, Jr.

C. Clark Dougherty, Jr.
Registration No. 24,208
McAFEE & TAFT
Two Leadership Square
211 N. Robinson, Tenth Floor
Oklahoma City, Oklahoma 73102
(405) 235-9621
ATTORNEY FOR APPLICANTS

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